

Primary Dendrite Arm Spacings in Al-7Si Alloy Directionally Solidified on the International Space Station

Samuel Angart, Mark Lauer, David Poirier, Surendra Tewari, Ravi Rajamure, Richard Grugel,

Abstract:

Samples from directionally solidified Al- 7 wt. % Si have been analyzed for primary dendrite arm spacing (λ) and radial macrosegregation. The alloy was directionally solidified (DS) aboard the ISS to determine the effect of mitigating convection on λ and macrosegregation. Samples from terrestrial DS-experiments thermal histories are discussed for comparison. In some experiments, λ was measured in microstructures that developed during the transition from one speed to another. To represent DS in the presence of no convection, the Hunt-Lu model was used to represent diffusion controlled growth under steady-state conditions. By sectioning cross-sections throughout the entire length of a solidified sample, λ was measured and calculated using the model. During steady-state, there was reasonable agreement between the measured and calculated λ 's in the space-grown samples. In terrestrial samples, the differences between measured and calculated λ 's indicated that the dendritic growth was influenced by convection.